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(12) **United States Patent**
Culver

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(54) **TACTILE FEEDBACK INTERFACE DEVICE
INCLUDING DISPLAY SCREEN**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

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Related U.S. Application Data

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(51) **Int. Cl.**
G09G 5/08 (2006.01)

(52) **U.S. Cl.** **345/157; 345/156; 345/167**

(58) **Field of Classification Search** **345/156, 345/157, 158, 159, 160, 161, 162, 163-169, 345/173, 184; 74/471 XY; 463/36-38**
See application file for complete search history.

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(57)

ABSTRACT

A control device including a housing and a carrier moveable with respect to the housing in a first rotary degree of freedom. A first sensor senses the movement of the carrier and outputs a first control signal. A roller rotatably coupled to the carrier rotates with the carrier in the first degree of freedom and rotates independently of the carrier in a second rotary degree of freedom. A second sensor senses rotary motion of the roller and outputs a second control signal. Preferably, an arm member coupled between carrier and housing pivots about an axis. A third sensor, such as a switch, can be used to detect when the carrier has been pushed in a direction substantially orthogonal to a plane of rotation of the arm member. Force feedback can also be provided in the rotary degrees of freedom of the control device.

32 Claims, 9 Drawing Sheets

